

Remarks

Claims 1-3, 5-14, 17-30, 40-42, and 44-52 are pending in this application. Claims 1, 2, 17, 44-48, and 51 have been amended. No claims have been cancelled. Accordingly, claims 1-3, 5-14, 17-30, 40-42, and 44-52 remain pending in this application.

Applicants extend their thanks and appreciation to the Examiner for the courtesy of a telephone interview on April 2, 2008. During the interview, Applicants discussed passages from textbooks defining block copolymers, as well as proposed claim amendments in response to the § 112 rejections and written description support for the proposed amendments.

Claim 44 has been amended to replace the term “at least 1% unreacted low molecular weight (“free”)” with the term “the free polyisocyanate.” This amendment was made to provide proper antecedent basis for “free polyisocyanate,” which was originally defined in claim 40, from which claim 44 depends.

Claims 45 and 46 have been amended to replace the term “at least 1% and less than about 5% unreacted low molecular weight (“free”)” with the term “the free polyisocyanate.” This amendment was made to provide proper antecedent basis for “free polyisocyanate,” which was originally defined in claim 40, from which claims 45 and 46 depend.

Moreover, claims 44-48 have been amended to provide sufficient antecedent basis for the recited copolymers initially defined in independent claim 40, from which claims 44-48 ultimately depend.

The remaining claim amendments are discussed below.

Rejections Under 35 U.S.C. § 112

Claims 1-3, 5-14, 17-30, 40-42, and 45-51 are rejected under 35 U.S.C. § 112, first paragraph. Applicants respectfully traverse this rejection.

Claim 1 is rejected for reciting a functionality of at least 1.5, and claim 2 is

rejected for reciting a functionality averaging 3. Claim 1 has been amended to recite a functionality in the range of 1.5-8. Support for this amendment can be found in the specification (Pub. No. US 2003/0135238) at ¶ [0065]. Claim 2 has been amended to recite “wherein the copolymer polyol is trifunctional.” Support for this amendment can be found in the specification at ¶ [0011].

Claim 17 has been rejected for reciting a free polyisocyanate content of “at least 1%” and not “greater than 1%” as asserted by the Examiner. Applicants have amended claim 17 to recite a free polyisocyanate content of “greater than 1% ... but less than 5% of said solution.”

Claims 45 and 51 have been rejected for reciting “less than 5% un-reacted low molecular weight polyisocyanate” where the Examiner asserts that paragraph [0067] envisions “at least 1% unreacted polyisocyanate.” Claims 45 and 51 have been amended to recite “free polyisocyanate” to provide antecedent basis for the same term initially defined in independent claim 40 as being present in an amount of “at least 1% and less than 5%” of the composition.

These claim amendments have been made for the sole purpose of expediting prosecution and do not constitute an acquiescence of the rejection. Applicants respectfully reserve the right to pursue the surrendered subject matter in a continuation application.

Rejections Under 35 U.S.C. § 102

Claims 1-3 and 8 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,624,972 (“Muller”). Applicants respectfully traverse this rejection.

Applicants respectfully submit that Muller does not anticipate claims 1-3 and 8 for at least the following two reasons:

1. Muller does not describe a composition comprising a low molecular weight free polyisocyanate in an amount of at least 1% but not more than 5% of said composition by weight; and
2. Muller does not describe a block copolymer polyol having 10-30% of the

monomers derived from propylene oxide monomers.

1. Muller does not describe a composition comprising a low molecular weight free polyisocyanate in an amount of at least 1% but not more than 5% of said composition by weight

Applicants respectfully submit that Muller does not disclose a low molecular weight free polyisocyanate in an amount of at least 1% but not more than 5% of said composition by weight. Instead, Muller's compositions comprise at least 20% or more of a free polyisocyanate.

Muller is directed to the manufacture of polyurethane-based foams, particularly through the use of a prepolymer method. (*Muller* at col. 1, ll. 61-63.) The prepolymer method involves reacting a polyisocyanate with a polyol to form a prepolymer containing free isocyanate. (*Id.* at col. 1, ll. 33-38.) The prepolymer containing the free isocyanate is then reacted with water to form the polymeric foam. (*Id.*) From Muller's numerous descriptions of the manufacturing method, it is evident that in addition to the free polyisocyanate present in the prepolymer, Muller requires combining an additional excess of free polyisocyanate to the polyisocyanate composition.

Muller's most general statement of invention is described as reacting 100 parts by weight of a polyisocyanate component with 1 to 20 parts of an isocyanate-reactive component (including at least 40% water). (*Id.* at col. 2, ll. 11-15.) The polyisocyanate component contains at least two polyisocyanates:

- a low NCO isocyanate-terminated prepolymer, and
- a high NCO polyisocyanate, e.g., tolylene diisocyanate (TDI) or a methylene bridged-polyphenyl polyisocyanate (free polyisocyanate).

(*Id.* at col. 2, ll. 18-23.) Thus, in the most general description, Muller's composition comprises a prepolymer (containing free polyisocyanate) plus an additional free polyisocyanate component.

More specifically, Muller describes the invention as comprising 100 parts by weight of a polyisocyanate component that is to be reacted with 1 to 20 parts of an isocyanate-reactive component (including at least 40% water). The polyisocyanate

component comprises at least two diphenylmethane diisocyanate compositions that are described as:

- 60-80% by weight of the polyisocyanate component being reacted residues of isocyanate-reactive species (prepolymer) and
- 20-40% by weight of the polyisocyanate component being methylene-bridged polyphenyl polyisocyanates or reactive residues thereof (free polyisocyanate).

(*Id.* at col. 2, ll. 59-65.) This more specific definition again describes a prepolymer component and a free polyisocyanate. The 60-80% by weight component of “reacted residues of isocyanate-reactive species” is defined in Muller as “prepolymers” obtained by reacting an isocyanate-reactive compound with a stoichiometric excess of MDI. (*Id.* at col. 3, ll. 2-7.) Reacting an isocyanate-reactive compound with a stoichiometric excess of MDI would result in a prepolymer plus an excess of MDI. The 20-40% by weight component of “methylene-bridged polyphenyl polyisocyanates” is defined in Muller as diphenylmethane diisocyanates and oligomers thereof, e.g., crude and polymeric MDI, i.e., free polyisocyanates. (*Id.* at col. 2, l. 66 to col. 3, l. 2.) Again, in addition to the stoichiometric excess of MDI present in the prepolymer composition, Muller requires an additional excess of free polyisocyanates.

Based on these definitions, a substantial portion, i.e., at least 20-40% by weight of the polyisocyanate component is a free polyisocyanate. Moreover, because the prepolymer also contains free polyisocyanate (due to the stoichiometric excess of MDI), this amount of free polyisocyanate in the prepolymer component would be combined with the 20-40% amount of added free polyisocyanate, resulting in greater than 20-40% free polyisocyanate in the composition.

This substantial amount of free polyisocyanate in the generalized descriptions is consistent with the more specific embodiments disclosed in Muller. A preferred reaction system of Muller comprises:

- (A) an isocyanate-terminated prepolymer (low NCO content of 2-15%) obtained by reacting an isocyanate-reactive polymer with an excess of diphenylmethane diisocyanate (prepolymer + free polyisocyanate),

- (B) a diphenylmethane diisocyanate composition (high NCA content of at least 20%) (free polyisocyanate)

(*Id.* at col. 7, l. 64 to col. 8, l. 16.) Muller provides that the total amount of components (A) and (B) equal 20-40% free polyisocyanates. (*Id.*) This composition of (A) and (B) components is then reacted component (C), the an isocyanate-reactive component containing at least 40% water by weight.

Muller's "most preferred" composition comprises:

- (A) an isocyanate-terminated prepolymer (low NCO content of 2-15%) obtained by reacting a polypropylene-polyethylene oxide polyol with a stoichiometric excess of diphenylmethane diisocyanate,
- (B) a diphenylmethane diisocyanate or a TDI composition (high NCO content of at least 20%).

(*Id.* at col. 8, ll. 17-37.) As above, the components (A) and (B) total contain 20-40% free polyisocyanates.

The Examples of Muller provide specific amounts of polyisocyanate components that are consistent with these disclosed ranges. Muller's Examples 1-6 describe compositions for the preparation of flexible foams. The ingredients for Examples 1-6 are defined under the "Glossary" section. (*Id.* at col. 9, l. 45 to col. 10, l. 23.) One skilled in the art would readily appreciate that the components of the Glossary section are not the actual foam compositions but rather the components or ingredients that are used to form Muller's polymeric foams. Among these components or ingredients are various polyisocyanate components, whether free or in prepolymer form. For example, MDI Polyisocyanates A, D, E, and F are the prepolymers, which Muller describes as being prepared with an excess of polyisocyanate. (*Id.* at col. 3, ll. 2-7.) The other components MDI Polyisocyanate B, C, G, and Suprasec DNR are defined by Muller as free polyisocyanates.

In each of Examples 1-6, Muller describes the compositional makeup prior to reacting with water (or the isocyanate-reactive component):

Example No.	Prepolymer	Free Polyisocyanate
1	MDI-A = 80%	MDI-B + MDI-C = 20%
2	MDI-A = 90%	MDI-B = 10%
3	MDI-D = 90%	MDI-C = 10%
4	MDI-E = 90%	Suprasec DNR = 10%
5	MDI-F = 90%	Suprasec DNR = 10%
6	MDI-A = 90%	MDI-G = 10%

As indicated in the table above, each composition contains at least 10% of added free polyisocyanate. In combination with the added free polyisocyanate, the prepolymers contain further free polyisocyanate as they were prepared with an excess of polyisocyanate.

Muller consistently discloses the use of a large excess of free polyisocyanate in a composition comprising a polyisocyanate prepolymer. In contrast, claims 1-3 and 8 recite a smaller amount of free polyisocyanate, i.e., at least 1% but no more than 5% of the composition. There is no indication from Muller of the use of such small amounts of free polyisocyanate as claimed. For at least this reason, Applicants respectfully submit that Muller fails to teach or disclose the claimed amount of free polyisocyanate.

2. Muller does not describe a block copolymer polyol having 10-30% of the monomers derived from propylene oxide monomers

Applicants respectfully submit that Muller fails to describe a block copolymer polyol having 10-30% of the monomers derived from propylene oxide monomers. Instead, for block copolymers, Muller describes copolyols having a majority (greater than 50%) of propylene oxide monomers.

The Examiner asserts that Muller discloses a polymeric composition containing propylene oxide/ethylene oxide units. The Examiner has acknowledged that for a random copolymer, Muller's copolyol has an ethylene oxide content of 10-80%, and for a block copolymer, the ethylene oxide content is 2-30%, resulting in a high propylene oxide content of 70-98%. (*Office Action* at p. 3.) Applicants had previously distinguished the present claims on at least the argument that each claim requires a

block copolymer and a propylene oxide content of 10% to 30%. As previously explained by the Applicants, because Muller disclosed an ethylene oxide content of 2-30% for block copolymers, and consequently a propylene oxide content of 70-98%, the claimed 10% to 30% range of propylene oxide was well below the range taught by Muller. (Amendment filed 09/20/2007.) However, the Examiner pointed to the Applicants' specification at ¶ [0034] (Pub. No. 2003/0135238) describing block structures as either random or regular and thereby equated Applicants claimed block copolymer with a random copolymer. (*Office Action* at p. 5.)

Applicants appreciate the Examiner's explanation of the rationale behind the rejection during the telephonic interview of April 2, 2008. It appears that the Examiner was concerned with the statement in the specification (¶ [0034] (Pub. No. 2003/0135238) that the "block structure can be random or regular." The Examiner believed this statement could encompass embodiments where the arrangement of monomers of each individual block can be random or regular, and therefore a polymer made of such blocks could result in a random copolymer.

Applicants respectfully submit that the definition of "block" is indisputable in the art, where the structure of each individual block can contain only one monomer type and cannot be random. In light of this well known meaning of "block," one of ordinary skill in the art would have interpreted the statement at ¶ [0034] to refer to the random or regular arrangement of a group of blocks in a polymer chain, and not to the group of monomers in an individual block.

Applicants submit excerpts from two text books to establish the well known definition of a block copolymer versus a random copolymer. The first text book "Polymer Chemistry: The Basic Concepts," by Paul C. Hiemenz, Marcel Dekker, Inc., NY, 1984, pp. 12, 433, and 434 ("Hiemenz") define various copolymer structures prepared from two monomers A and B. At p. 12, Hiemenz describes a random copolymer prepared from monomers A and B as having the structure:

-AAABABABBABBB-

In contrast, according to Hiemenz, a block copolymer comprises a long uninterrupted sequence of each monomer, as exemplified by the structure:



Similar definitions of block and random copolymers are provided in the textbook “Encyclopedia of Chemical Processing and Design,” John J. McKetta and William A. Cunningham, Eds., Marcel Dekker, Inc., New York, 1992, pp. 32, 33, and 43-45 (“McKetta”). McKetta defines a random copolymer as having the structure:



(McKetta at p. 32.) Because of the random arrangement of monomers A and B in the polymer chain, McKetta teaches that when examining any section of a chain containing greater than 10 monomer units, a random copolymer would show a constant composition of both monomer units A and B. (*Id.*)

McKetta defines a block copolymer as having the structure:



(*Id.*) McKetta states that unlike a random copolymer, examining any section of a chain of a block copolymer would expose a section containing either all A units or all B units, except for the points at which A and B are bonded to each other. (*Id.*) This represents a very different structure from a random copolymer where a mixture of A and B components are observed in any section of the chain.

One of ordinary skill in the art can readily appreciate the difference in chemical structure of the random copolymer versus the block copolymer. A random copolymer will not contain long interrupted sequences of a single monomer that is present in a block copolymer. Alternatively stated, a random copolymer does not contain block segments. A block copolymer, in contrast, will always contain block segments.

The block or random nature of a copolymer can have an effect on the resultant physical properties of the copolymer, as taught by Hiemenz at pp. 433-4. According to Hiemenz, the properties of random copolymers are the average of the constituent monomers due to the persistent mixture of A and B monomer units throughout the length of the random copolymer chain. In contrast, the physical properties of block

copolymers resemble more closely a blend of homopolymers comprising the respective monomers, i.e., the properties of a block copolymer made of monomers A and B is similar to those of a blend of homopolymer A and homopolymer B because of the separate regions of “A” block and “B” blocks. The structure and property distinctions between random and block copolymers are echoed in the text of McKetta. In a polymer film containing a block copolymer, each block forms domains due to the different properties of monomers A and B. (*McKetta* at pp. 43-44.) A domain made of a block containing monomer A can phase separate from a domain of a block containing monomer B. These domains do not form in a random copolymer; because of the uniform mixture of A and B in the polymer chain of a random copolymer, there is an insufficient collection of A or B blocks to form individual A or B block domains. Thus, one of ordinary skill in the art examining the properties of block copolymers versus random copolymers would note distinct differences in properties between the two types of copolymers due to the presence of blocks in a block copolymer.

As noted in Heimenz at p. 433, random copolymers having a certain proportion of monomers, e.g., a 50:50 proportion of A:B monomers can have different properties from a block copolymer with the same 50:50 proportion of A:B monomers. Hiemenz illustrates what is well known in the art, that the presence of blocks versus the random distribution of monomers (absence of blocks) dictates the physical properties of the resultant copolymer.

Accordingly, the passage in the specification at ¶ [0034] would be well understood in the art to refer to the random or regular arrangement of blocks in the polymer chain, and not to the random or regular arrangement of monomers of each individual block.

A random arrangement of blocks would not produce a random copolymer, as believed by the Examiner, but rather would result in a random block copolymer, which would still maintain blocks of monomers A or B in the polymer chain. Random block copolymers are well known in the art as evidenced by the literature reference “Semiflexible Random A-B block Copolymers Under Tension,” Debnath et al., *Journal of Chemical Physics* 118(4):pp. 1970-1978 (2002) (“Debnath”). Debnath describes the

semiflexibility of “individual blocks,” of random A-B block copolymers. (*Debnath* at abstract.) In Debnath, a random block copolymer is defined as a random linked sequence of two different kinds of “prepolymer,” A or B, where each prepolymer is a chain of identical residues. (*Id.* at p. 1970.) Each prepolymer can span a range of different degrees of flexibility. (*Id.*)

One of ordinary skill in the art would readily understand that the “prepolymer” of Debnath is the equivalent of a block where the copolymer comprises a series of prepolymers where each prepolymer contains a chain of identical A or B residues (not both). This definition is the equivalent of a block copolymer, where each block contains a chain of identical A or B monomers. Debnath specifically describes random block copolymers as being a “random linked sequence” of prepolymers or blocks. Thus, in a random block copolymer, each individual prepolymer or block contains only A or B monomers; the randomness arises from the random sequence of the blocks and not the random sequence of individual A or B monomers, as this would defy the well known definition of a “block.” Again, Debnath confirms the definition of a block copolymer, in that the block or prepolymer unit contains solely A or B monomers. Debnath further confirms that random block copolymers are well known in the art to maintain block structures in the polymer chain.

Finally, Applicants note that the cited reference itself, Muller, acknowledges the existence of random block copolymers. In describing the amounts of ethylene oxide in the copolymer, Muller lists the amounts for random copolymers, block copolymers, and “random/block copolymers.” (*Muller* at col. 4, l. 67 to col. 5, l. 5.) The amounts of ethylene oxide for each copolymer type, and the corresponding amounts of propylene oxide are tabulated below.

Copolymer Type	% ethylene oxide	% propylene oxide
random copolymers	10-80%	20-90%
block copolymers	2-30% ethylene oxide	70-98%
random/block copolymers	up to 50%	greater than 50%

From this disclosure, Muller provides an explicit teaching of the amounts of ethylene oxide (and thus, propylene oxide) depending on the block nature of the polymer. One of ordinary skill in the art can readily appreciate a trend from Muller. In a random copolymer, a greater variation of ethylene oxide (and thus, propylene oxide) amounts can be incorporated into the polymer. At the other extreme, only up to 30% ethylene oxide can be incorporated in a block copolymer, leaving 70-98% of the blocks formed from polyethylene oxide monomers. The random block copolymer can have an ethylene oxide content ranging up to 50%, or a propylene oxide content of greater than 50%, which is a value intermediate that of the random copolymers and block copolymers.

The specific examples of Muller fall within these ranges. Each of the Examples 1-6 contain at least one of the prepolymers MDI Polyisocyanate A, D, E, or F. "MDI Polyisocyanate A" (col. 9, ll. 45-48) is defined in the Glossary as a prepolymer formed from "750 parts of an ethylene oxide tipped polyoxypropylene." (*Id.* at col. 9, ll. 45-48.) Alternatively stated, this polymer is a polyoxypropylene tipped or capped with an ethylene oxide. This description indicates essentially a homopolymer of polyoxypropylene except for the capping ethylene oxide unit. As a result, this prepolymer would necessarily include a very high proportion of propylene oxide save for the ethylene oxide at the tip of the polymer. MDI Polyisocyanate A would not fall within the scope of the claims as it has a propylene oxide content well above the claimed upper limit of 30%.

"MDI Polyisocyanate D" (col. 9, ll. 55-59) is a prepolymer having the "above mentioned polyether triol," i.e., the same polyether triol as MDI Polyisocyanate A, which contains a very high propylene oxide content well above the claimed upper limit of 30%.

"MDI Polyisocyanate E" (col. 9, l. 60 to col. 10, l. 3) is a prepolymer having an "overall ethylene oxide content" of about 27% relative to the total amount of oxyalkylene residues." This prepolymer provides about 73% propylene oxide, more than double the amount of the claimed upper limit of 30%.

"MDI Polyisocyanate F" (col. 10, ll. 4-9) is a prepolymer having a polypropylene oxide/ethylene oxide with an ethylene oxide content of 10.9% "by weight as tipping," i.e.,

the ethylene oxide tips the polymer ends. Again, this polymer is very high in propylene oxide content and is well above the claimed upper limit of 30%.

Examples 1-6 are polyisocyanate compositions formed by combining the various prepolymer polyisocyanates (+ excess polyisocyanate) with free polyisocyanate. Because each of the polyalkylene-containing polymers contain a very high proportion of propylene oxide (well above 30%), the combination of these polymers would necessarily result in a product having a very high propylene oxide content with respect to the polyalkylene polymer.

Throughout the specification, Muller consistently describes polyethers having a high propylene oxide content where the polyether is a block copolymer. Accordingly, Applicants respectfully submit that Muller fails disclose the claimed copolymer structure.

Applicants respectfully submit that Muller fails to disclose or suggest each and every limitation of the claimed invention, e.g., the amount of free polyisocyanate and the amount of propylene oxide in the copolymer copolyol. Accordingly, Applicants respectfully request withdrawal of this rejection.

Rejection Under 35 U.S.C. § 103

Claims 5-7, 9-14, 17-30, 40-42, and 44-52 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Muller. Applicants respectfully traverse this rejection.

As discussed above, the limitations of claims 1-3 and 8 are not disclosed by Muller. Moreover, these limitations are not taught or suggested by Muller. As discussed in detail above, Muller provides numerous disclosures that show trends leading one of ordinary skill in the art away from (1) the claimed amount of free polyisocyanate of at least 1% not more than 5% free polyisocyanate, and (2) the claimed amount of propylene oxide monomers in the copolymer polyol. Claims 5-7 and 9-14 depend from claim 1 and for at least these same reasons, are not rendered obvious by Muller.

Each of independent claims 17, 40, and 51 recite free polyisocyanate of at least 1% not more than 5% free polyisocyanate, and propylene oxide monomers in the copolymer polyol ranging from 10-30%. For at least the same reasons outlined above,

independent claim s 17, 40, and 51 are not rendered obvious by Muller. Accordingly, Applicants respectfully request withdrawal of this rejection.

Reconsideration

It is believed that all claims of the present application are now in condition for allowance.

Reconsideration of this application is respectfully requested. If the Examiner believes that a teleconference would expedite prosecution of the present application the Examiner is invited to call the Applicant's undersigned attorney at the Examiner's earliest convenience.

Any amendments or cancellation or submissions with respect to the claims herein is made without prejudice and is not an admission that said canceled or amended or otherwise affected subject matter is not patentable. Applicant reserves the right to pursue canceled or amended subject matter in one or more continuation, divisional or continuation-in-part applications.

To the extent that Applicant has not addressed one or more assertions of the Examiner because the foregoing response is sufficient, this is not an admission by Applicant as to the accuracy of such assertions.

Please grant any extensions of time required to enter this response and charge any fees in addition to fees submitted herewith that may be required to enter/allow this response and any accompanying papers to our deposit account 02-3038 and credit any overpayments thereto.

Respectfully submitted,

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